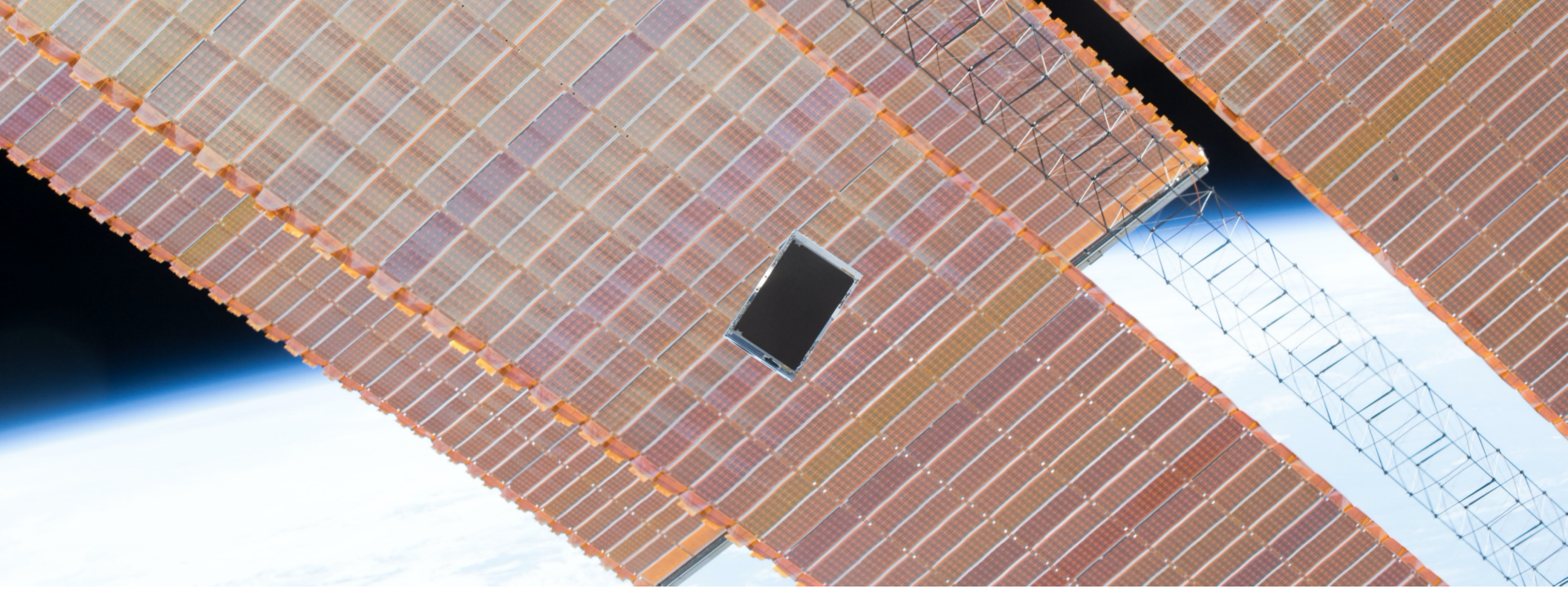


ASTERIA

High-Precision Photometry in a Small Package

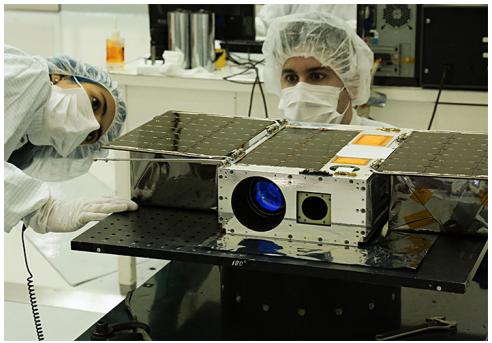
Jet Propulsion Laboratory
California Institute of Technology

Matthew W. Smith[1], Amanda Donner[1], Mary Knapp[2], Christopher Pong[1], Colin Smith, Jason Luu[1], Peter Di Pasquale[1], Robert L. Bocchino Jr.[1], Brian Campuzano[1], Jessica Loveland[1], Cody Colley[1], Alessandra Babuscia[1], Mary White[1], Joel Krajewski[1], Sara Seager[2]

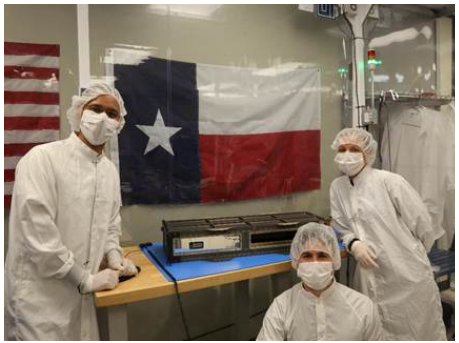
[1]Jet Propulsion Laboratory, California Institute of Technology, California, United States
[2]Massachusetts Institute of Technology, Massachusetts, United States

Mission Overview

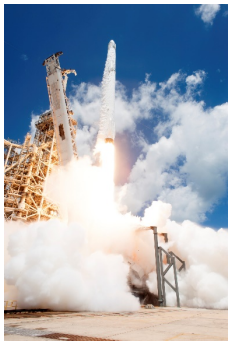
- Prime mission: Demonstrate precision pointing and thermal control technologies
- Extended mission: Conduct dedicated science observations, further characterize hardware and software components
- 6U built, tested, operated at JPL; science team at MIT (S. Seager, PI) and U. Bern
- Funded through JPL's Phaeton Program for early career training plus MIT contributions to operations
- 250+ days of operation in space



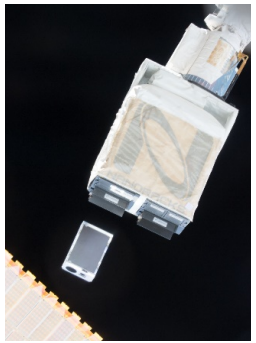
Development
Dec 2014 through Jun 2017



Delivery
1 Jun 2017



Launch
14 Aug 2017

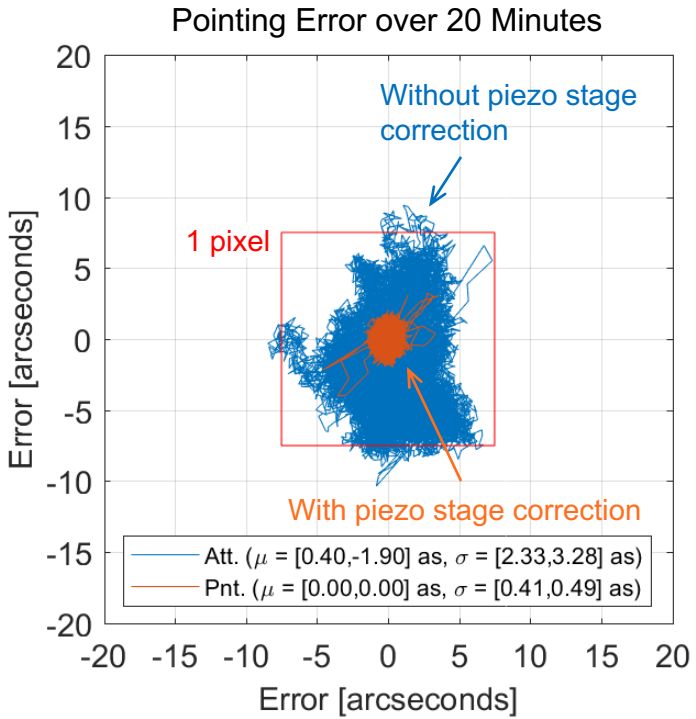


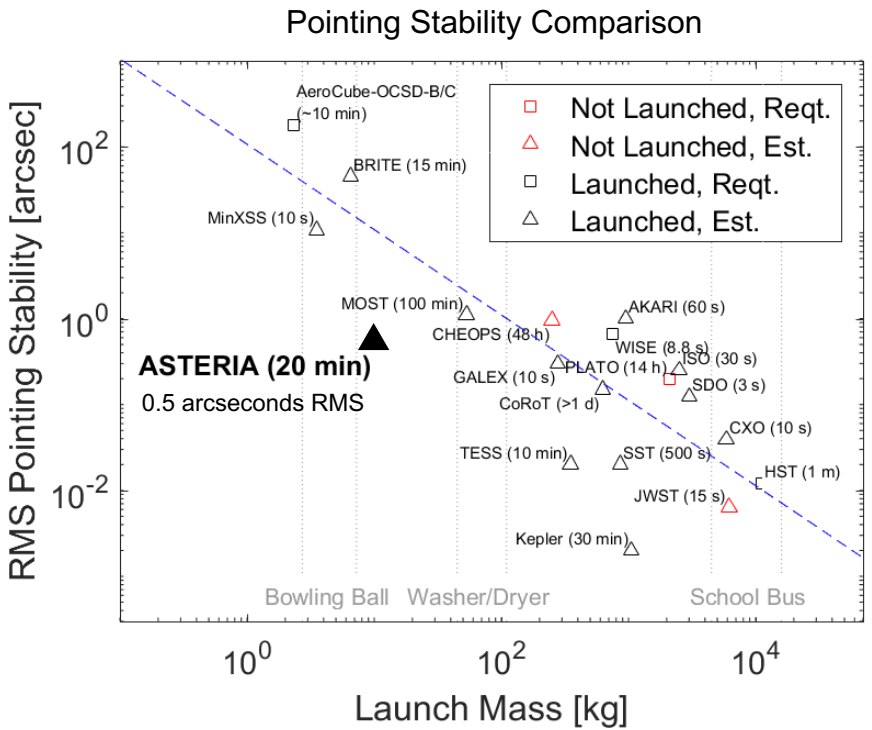
Deployment
20 Nov 2017

Operations
Through Sep 2018

Pointing Control Results

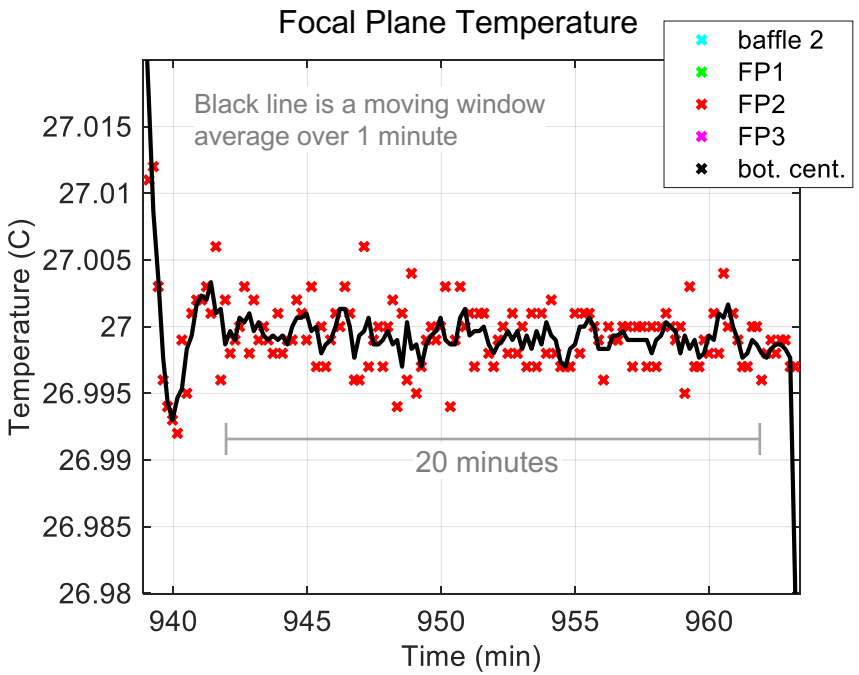
Achieved pointing error < 0.5 arcseconds RMS over 20 minutes

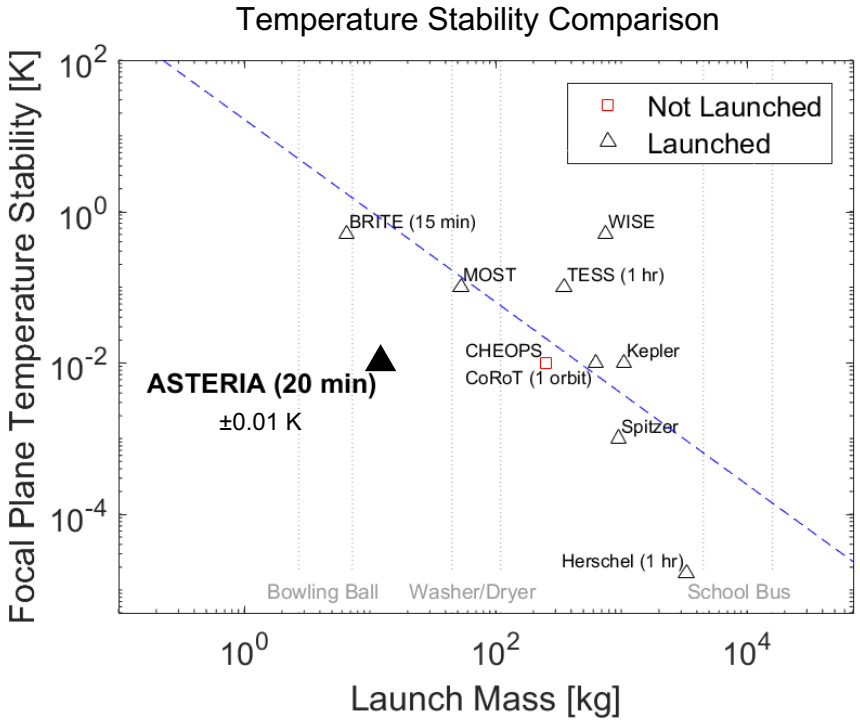




Thermal Control Results

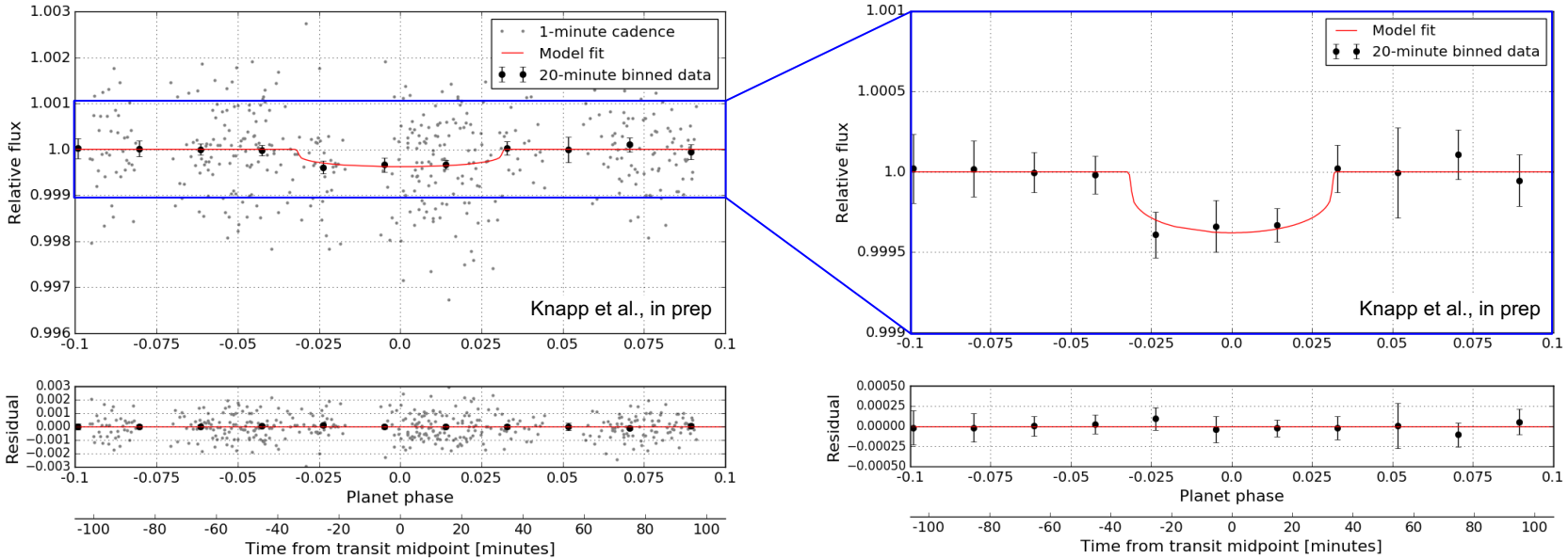
Achieved focal plane thermal control < ±0.01 K over 20 minutes





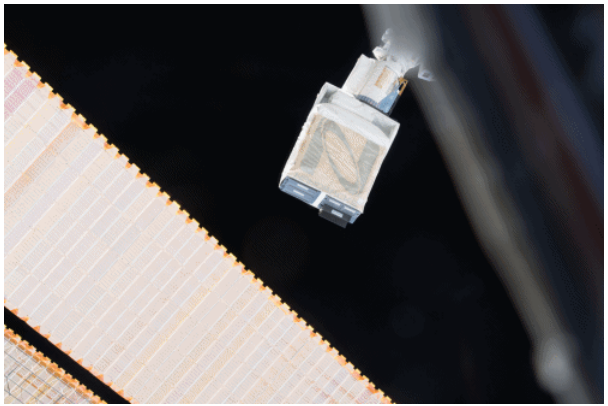
Exoplanet Transit Detection

Observed the known transit of super-Earth exoplanet 55 Cancri e



410 ppm transit observed at SNR=3, super-Earth exoplanet ($2R_E$) around a V=5.95 Sun-like star. Photometric precision is 730 to 1140 ppm/min.

Conclusion and Next Steps



- Achieved significantly improved pointing and thermal control for small spacecraft
  - Pointing stability: < 0.5 arcseconds RMS over 20 minutes
  - Pointing repeatability: 1 milliarcsecond RMS from orbit to orbit
  - Thermal stability: ±0.01 K over 20 minutes at the focal plane
- Observed the known transit of 55 Cancri e, offering a proof-of-concept for performing exoplanet detections using a CubeSat platform
- Currently conducting an extended mission to seek new exoplanet transits